[001] HYDRODYNAMIC TORQUE CONVERTER

[002]

[003]

[004] The invention concerns a hydrodynamic torque converter of the type defined in more detail in the preamble of claim 1.

[005]

[006] Hydrodynamic torque converters are often inserted between a drive engine and a speed-shift transmission, particularly in the case of working machines such as wheel loaders, stackers or graders. In this, the momentary output torque delivered by the torque converter is very important for the control, preferably of the speed-change transmission.

[007] DE 195 21 458 A1 discloses an electro-hydraulic control device for the drive of a machine with a torque converter, which comprises a clutch between the pump impeller wheel and the drive engine and in which the speed of the drive engine and the speed of the transmission are determined and passed on to an electronic control unit.

[008] The purpose of the present invention is to determine the output torque of a hydrodynamic torque converter in which a clutch connects the pump impeller wheel of the torque converter to a drive engine, with precision at any operating point.

[009] This objective is achieved with a hydrodynamic torque converter of the generic type described, which also comprises the characterizing features of the principal claim.

[010]

[011] The hydrodynamic converter is driven by a drive engine via a clutch, according to the invention; this clutch is arranged ahead of the pump impeller wheel of the hydrodynamic torque converter. The clutch can be arranged inside the converter housing or outside it. Likewise, the clutch can be arranged inside the change-under-load transmission positioned on the output side. A rotation speed

sensor detects the speed of the turbine rotor or that of a component in rotationally fixed connection with the turbine rotor, such as components in the drive train of the gearshift mechanism, and a rotation speed sensor detects the speed of the pump impeller wheel, and both these speed signals are transmitted to an electronic control unit. Since the speed of the pump impeller wheel is determined, the electronic control unit can determine the torque of the turbine rotor with reference to stored hydrodynamic torque converter values. Since the speed of the pump impeller wheel is determined directly, the torque of the turbine rotor can be determined by the electronic control unit even if there is clutch slip between the drive engine and the pump impeller wheel, which would not be possible if only the speed of the drive engine and that of the turbine rotor were being determined.

[012] Preferably, radially on the inside the pump impeller wheel has a flange at the axial end of which are arranged means enabling the detection of the rotation speed. Preferably, these means are in the form of cams. Thus, a speed sensor or a Hall sensor can produce the speed signals when the pump impeller wheel is rotating.

[013] In another embodiment the speed sensor is arranged axially or radially in a component held in rotationally fixed connection with the stator.

[014] In a further embodiment the flange connected to the pump impeller wheel extends into a change-under-load transmission arranged on the output side, in which the clutch can also be located. In this embodiment the speed sensor is also arranged in the transmission housing in a component held in rotationally fixed connection.

[015]

[016] Further characteristics emerge from the description of the figures, which show:

[017] Fig. 1 is a hydrodynamic torque converter with a primary clutch and a converter bridging clutch;

[018] Fig. 2 is a hydrodynamic torque converter with a primary clutch arranged adjacent to the turbine rotor; and

[019] Fig. 3 is a hydrodynamic torque converter with a primary clutch arranged in a transmission housing.

[020]

[021] Fig. 1:

A converter housing 1 is in rotationally fixed connection with a drive engine (not shown). A pump impeller wheel 2 can be connected to the converter housing by a clutch 3, which is the so-termed primary clutch. Depending on the actuation pressure in a space 4 and on the converter housing pressure in a space 5, the clutch produces a transmissible torque such that the hydrodynamic torque converter can even be operated when there is slippage of the clutch 3. The converter housing 1 can be connected directly to a turbine rotor 7 by means of a converter bridging clutch 6. A stator 8 is in rotationally fixed connection with a positionally fixed component 9. Radially on the inside, the turbine rotor 2 has a flange 10 which, on the one hand, serves to support the turbine rotor and, on the other hand, has on its inner axial extension 11 cams 12 that enable the speed to be detected by a speed sensor 13. The speed sensor 13 is arranged in the positionally fixed component 9, allowing the signal leads to be positioned statically. A further speed sensor (not shown) determines the rotation speed of the turbine rotor 7, and the signals giving the speed of the turbine rotor 7 and the speed of the pump impeller wheel 2 are passed on to an electronic control unit (not shown) in which characteristic hydrodynamic torque converter values are stored, and which can determine the torque of the turbine rotor with reference to those values. Likewise, it is possible to transmit to the electronic control unit further signals from temperature and pressure sensors, so as to render the calculation of the torque more precise.

[022] Fig. 2:

The converter housing 1 is connected to a drive engine (not shown). The pump impeller wheel 2 can be connected to the converter housing 1 by the clutch 3, this clutch 3 being arranged adjacent to the turbine rotor 7. The clutch 3 is actuated as a function of the pressures in the spaces 4 and 5. Radially on the

inside, the pump impeller wheel 2 has a flange 10 which, at the same time, supports the pump impeller wheel via a bearing 14, and on its axial extension 11 the flange 10 has cams 12 which enable a rotation speed sensor, which can be arranged axially or radially in the positionally fixed component 9, to determine the speed of the pump impeller wheel 2.

[023] Fig. 3:

A converter housing 1 is in rotationally fixed connection with a drive engine (not shown). A flange 15 of the converter housing 1 extends into a transmission housing 16 and is in rotationally fixed connection with a disk carrier 17 of the clutch 3. Radially on the inside, the pump impeller wheel 2 has a flange 10 which extends into the transmission housing 16 and which is in rotationally fixed connection with a disk carrier 18 of the clutch 3. By means of the clutch 3, the pump impeller wheel 2 can be connected to the converter housing 1 and so also to the drive engine. In a positionally fixed component of the transmission housing in which a pressure feed line 19 for the clutch 3 can also be arranged, there is a rotation speed sensor 13 which determines the speed of the pump impeller wheel 2 by virtue of cams 12. The cams 12 are at the axial end of the flange 10. The turbine rotor 7 is in rotationally fixed connection with a shaft 20 which constitutes the drive input of the change-under-load transmission connected after the converter. The speed of the turbine rotor 7 can be determined by a rotation speed sensor from the shaft 20. The cams 12 are arranged parallel to a rotation axis 21. The speed sensor can be arranged parallel or at right angles to the rotation axis 21.

Reference numerals

1	Converter housing
2	Pump impeller wheel
3	Clutch
4	Space
5	Space
6	Bridging clutch
7	Turbine rotor
8	Stator
9	Positionally fixed component
10	Flange
11	Axial extension
12	Cams
13	Rotation speed sensor
14	Bearing
15	Flange
16	Transmission housing
17	Disk carrier
18	Disk Carrier
19	Pressure feed line
20	Shaft
21	Rotation axis